
Space Weather Technical Forecast

Issued on Thursday, 17 November 2022 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Decreasing chance of M-class flares (Minor to Moderate radio blackouts) throughout. Very slight chance of S1 (Minor) Radiation Storms and X-class flares (Strong radio blackouts) to start. Chance of G1 (Minor) geomagnetic storm periods Day 3 (19 Nov) onwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been at Low levels, with often frequent but low level C-class flare activity, mostly originating from AR3140 and AR3145. There are currently six numbered regions on the visible disc. AR3140 now transiting the northwest limb remains the largest and most complex region though current position makes any changes hard to discern. AR3141 situated a little further south is also about to reach the western horizon and suffers from a similar problem. AR3145, again in the northwest, has shown new spot development in its lead portion and is now re-classified Cai/Beta. AR3146 has lost a small lead spot, and is re-classed as Axx/Alpha. Two regions in the southeast, AR3147 a large single spot and AR3148 a much smaller Bxo/Beta, both have shown little development since emerging onto the visible disk. A new region is currently emerging around the northeast limb, full classification difficult due to position but looks to be small and assessed as Bxo/Beta for now.

No significant Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1 by ACE/DSCOVR, has been slow-ambient between 310-400 km/s with a gradually reducing trend. Density has been at average to below average levels. The total magnetic field strength (IMF) has been weak throughout remaining below 6 nT. The north-south component, Bz, has fluctuated weakly between +5/-4 nT. Phi angle remained negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at background to moderate levels, with a peak of 443 pfu at 16/1740 UTC. Electron fluence levels remained well below Active (1e8 integrated pfu) levels, with a very slight rising trend. Observed fluence at 17/00000 UTC was 6.89e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain generally Low during the period. There is a diminishing chance of isolated M-class flares throughout and a slight chance of isolated X-flares through days 1 (17 Nov) and 2 (18 Nov), most likely from AR3140 as it rotates away.

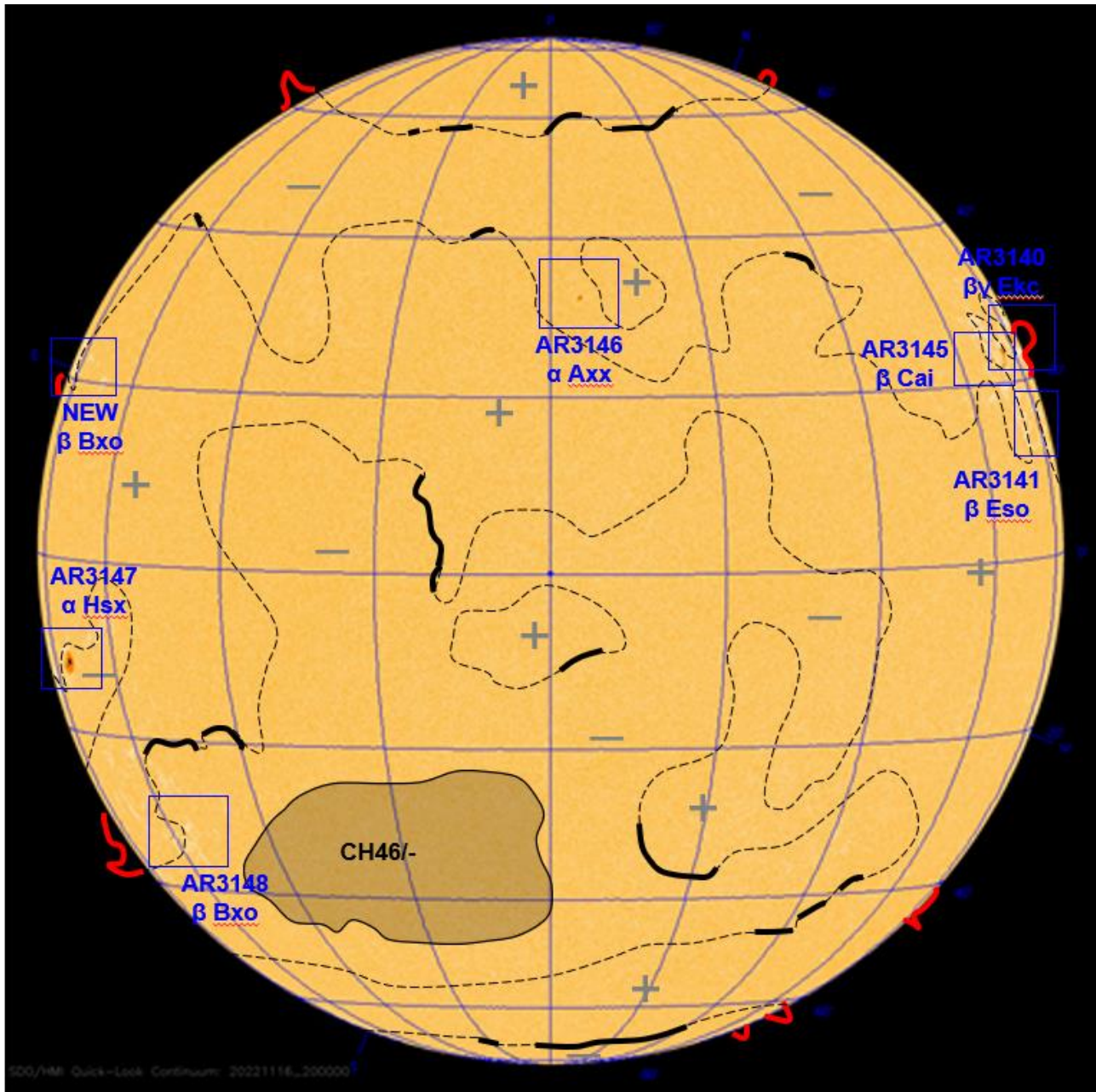
Solar Wind / Geomagnetic Activity: No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible from a weak glancing passage, late on day 1 (17 Nov) or during day 2 (18 Nov).

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Solar winds are currently at slow-ambient levels and expected to remain so through Days 1 and 2. An enhancement is expected during on Day 3 (19 Nov) as the large negative polarity coronal hole in the southwest disk becomes geoeffective, with enhancement persisting into Day 4 (20 Nov). Geomagnetic activity is forecast to be predominantly Quiet to Unsettled through Day 1 and into 2, a very slight chance of isolated Active interval should any CME effects manifest. Later on Day 2 and into Days 3 and 4, Unsettled to Active levels expected with a chance of G1 (Minor) geomagnetic storm periods under HSS influence.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is most likely to remain at background levels throughout. However, there is a slight chance of a solar radiation storm from AR3140 and AR3141 in the far northwest to start. Electron flux is forecast to remain at mostly background to moderate levels throughout the period. Moderate or perhaps briefly High electron flux is possible at diurnal maxima from Day 1 (17 Nov) onward, but with low confidence. Fluence values are expected to remain below or well below the Active ($1e8$ integrated pfu) threshold throughout the period.

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible. Two filament lift-offs were observed on the 13 Nov and 14 Nov, and these are predicted to pass ahead of Earth's orbit, but could give a weak glancing blow either late on Day 1 (17 Nov), or more likely, during Day 2 (18 Nov). Significant impacts are unlikely if encountered at Earth. A partial filament eruption in the southwest quadrant around 16/1200 UTC resulted in a slow CME. We await model data for this event but a potential glancing blow is possible, most likely after the forecast period.

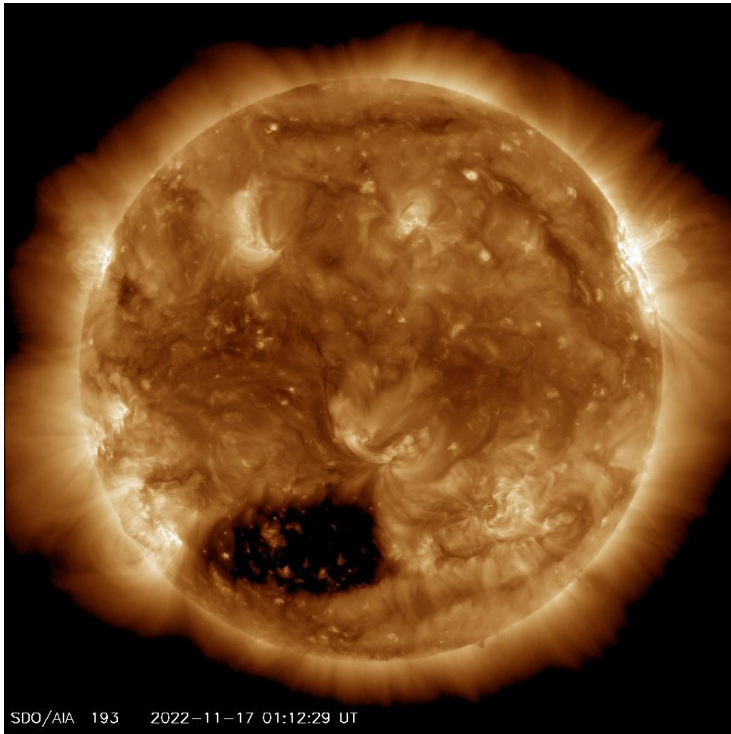
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Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	10	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: SDO 193 image 17/0112 UTC showing CH46/- in the SE disk



Radio Blackouts - X-Ray Flares:

Solar activity is expected to remain generally Low during the period. There is a diminishing chance of isolated M-class flares throughout and a slight chance of isolated X-flares through days 1 and 2, most likely from AR3140 as it rotates away.

AR3140 and AR3141 are expected to fully rotate off the visible disc during Day 1 (17 Nov) and AR3145 into Day 2 (18 Nov), although they still pose some risk, albeit diminishing, of flaring beyond the western limb. No further significant active regions currently expected to rotate onto the disk until perhaps Day 4 (20 Nov).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	30	10	10
Very Active	R3 to R5 X Class	No	10	5	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, as observed by GOES-16, is currently at background levels and is most likely to remain at this level throughout the period. However, the presence of AR3140 and AR3141 toward the northwest limb will continue to pose a declining risk of proton storms over background conditions, and this is reflected in the probabilities given in the table.

Radiation Storms	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	10	10	5	1
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

Electron flux (greater than 2MeV) is currently at mostly background levels and is forecast to be at background to moderate levels through much of the coming 4-day period. Moderate or perhaps briefly High electron flux is possible at the diurnal maxima from Day 2 (17 Nov) onwards, though with low confidence. Persistently high levels are considered very unlikely.

Electron fluence values are well below the Active ($1\text{e}8$ integrated pfu) threshold and are expected to remain so throughout the period, with a slight rising trend possible day 1 (17 Nov). The MOSWOC REFM output currently supports electron fluence values remaining below the Active threshold which offers good guidance. Fluence levels on the last rotation remained below the Active threshold with slightly faster wind speeds, and a similar trend is considered to be a probable outcome.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	1
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 3: REFM model, forecast considered generally good guidance

